

U.S. Patent Application Serial No. 10/699,832
Amendment filed May 24, 2006
Reply to OA dated January 6, 2006

REMARKS

Claims 1, 3-5 and 10-13 are pending in this application. Claims 1, 3-5, 10, 12 and 13 are amended herein. Upon entry of this amendment, claims 1, 3-5 and 10-13 will be pending.

No new matter is added by these amendments. Support for the amendments is discussed below.

Claims 1, 3-5 and 10-13 are rejected under 35 U.S.C. §102(b) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Linthicum, of record. (Office action p. 2)

Reconsideration of the rejection is respectfully requested in view of the amendments to the claims. The amendments clarify the recitation of the invention.

Applicant had previously amended claim 1 to recite “a region of silicon carbide formed by locally metamorphosing the monocrystalline silicon substrate into silicon carbide,” in particular adding the words “by locally metamorphosing” and “into silicon carbide.” The Examiner states that the added limitation in claim 1 “does not structurally distinguish the final product over Linthicum.”

In the present amendment to claim 1, the claim is amended to recite two areas: “one area having at least one layer, wherein none of the layers of said one area is metamorphosed,” and “another area,” which has “a layer of silicon carbide metamorphosed by locally carbonizing the corresponding area in the monocrystalline silicon substrate; and a layer of monocrystalline gallium nitride grown on said layer of silicon carbide.” General support for the term “area” may be found

in original claim 1. The “layer of silicon carbide metamorphosed” corresponds to the “region of silicon carbide formed by locally metamorphosing ...” in the claim before the present amendment. The “region of monocrystalline gallium nitride” has been amended to --**layer** of monocrystalline gallium nitride--, again replacing “region” with --layer--.

Support for the recitation of “locally carbonizing” may be found in the specification on page 5, lines 9-21. These lines disclose a specific process for “modification of the silicon” that involves placing the substrate in a chamber at an atmosphere of 1200 to 1405 °C while streaming hydrogen gas and hydrocarbon-based gas such as propane, methane, etc.

The Examiner states that Linthicum shows “local” areas in Fig. 49, and therefore the “locally” wording does not serve to distinguish from Linthicum. However, claim 1, as amended, further clarifies that the “one area” does **not** have any layers metamorphosed, while the “another area” has the locally carbonized monocrystalline silicon substrate. This can be seen, for example, in Figs. 1E to 1H of the present application, in which the silicon substrate is modified into silicon carbide only in parts 210, yielding monocrystalline silicon carbide regions 300 (see specification on page 5, lines 4-10). This can also be seen in Fig. 2H. Applicant submits that Linthicum does **not** disclose or suggest two areas as recited in amended claim 1, since in Linthicum, the silicon carbide is epitaxially grown on the top of the **entire** surface.

The present invention as claimed in the amended claims has the following outstanding features and advantages:

- 1) Use of the claimed substrate enables the formation of both electronic devices such as LSIs

and optical devices such as LEDs and laser diodes in one and the same substrate. Such configuration may ease electrical connections between electronic and optical devices and minimize signal lines in length.

- 2) A monocrystalline silicon substrate is locally metamorphosed by carbonization to form a silicon carbide layer, on top of which a monocrystalline gallium nitride layer is grown up. The obtained gallium nitride layer is of high quality, which may contribute to improved quality of the optical devices.

With the above features, the present invention has great significance in miniaturization, cost reduction and enhanced performance of an electronic-optical united device. Specifically, Linthicum does not expressly disclose that both electronic devices such as LSIs and optical devices such as LEDs and laser diodes are formed in one and the same substrate.

Claims 1, 3-5 and 10-13 are therefore not anticipated by, and not obvious over, Linthicum.

Claims 1, 4, 5, 11 and 13 are rejected under 35 U.S.C. §102(b) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as obvious over Arai et al. JP'039. (Office action p. 3)

The Examiner cites Arai et al. in Drawings 10-12, stating that these figures anticipate claim 1, depending on the interpretation of "metamorphosing".

Reconsideration of the rejection is respectfully requested in view of the amendments to the claims.

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The Examiner states that Drawing 12 of the reference shows silicon substrate 1, silicon carbide region 16 on substrate 1, and gallium nitride layer 19 and thin film 20 on silicon carbide region 16.

However, as noted above, as amended, claim 1 recites two areas, one of which has none of the layers metamorphosed. Applicant notes that Arai et al. describes the silicon carbide layers in paragraph [0036], and thin film 16 is epitaxially grown from silane and butane. Applicant submits that Arai et al. does not disclose or suggest two areas as in claim 1.

In addition, Arai et al. does not suggest the features and advantages discussed above for the pending claims.

Claims 1, 4, 5, 11 and 13 are therefore not anticipated by, and not obvious over, Arai et al. JP'039.

Claims 1, 3-5 and 10-13 are rejected under 35 U.S.C. §103(a) as unpatentable over Arai in view of Sawaki, JP'646. (Office action p. 4)

Reconsideration is respectfully requested in view of the amendments to the claims.

Sawaki is cited as using SiN as a mask for GaN grown on Si. The Examiner appears to be applying this reference in particular in regard to claims 3, 10 and 12. These claims recite the further region of SiN in addition to the region of GaN.

The Examiner appears to refer to paragraph [0054] in Sawaki, disclosing a GaN layer on Si. Applicant submits, however, that it is unclear how the disclosure of Sawaki is being combined with

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Arai et al. That is, it is unclear how Sawaki and Arai can be combined to produce a device that it operable for either Sawaki's or Arai's purpose.

Moreover, Applicant has noted above with regard to the rejection over Arai et al. in paragraph no. 3 of the Office action that Arai et al. does not disclose or suggest the two areas recited in claim 1. Applicant submits that there is also no disclosure or suggestion in Sawaki for this recitation of claim 1.

In addition, there is no suggestion in Sawaki for the features and advantages discussed above for the pending claims.

Claims 1, 3-5 and 10-13 are therefore not obvious over Arai et al. and Sawaki, JP'646, taken separately or in combination.

Claims 1, 3-5 and 10-13 are rejected under 35 U.S.C. §103(a) as unpatentable over Arai in view of Sawaki and further in view of Linthicum. (Office action p. 4)

Reconsideration of the rejection is respectfully requested in view of the amendments to the claims.

As noted above, none of Arai et al., Sawaki, and Linthicum discloses or suggests the two areas recited in claim 1, as amended. Moreover, there is no disclosure or suggestion for the features and advantages discussed above for the pending claims.

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Claims 1, 3-5 and 10-13 are therefore not obvious over Arai, Sawaki, and Linthicum, taken separately or in combination.

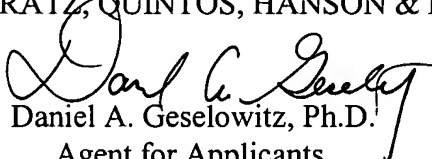
In view of the aforementioned amendments and accompanying remarks, claims 1, 3-5 and 10-13, as amended, are believed to be patentable and in condition for allowance, which action, at an early date, is respectfully requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact the Applicant's undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, the Applicant respectfully petitions for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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